

DESIGN & APPLICATIONS

1, 2 and 3 watt power modules with single to three phase input voltage range of 90-528VAC

Aimtec is a manufacturer of modular power supplies headquartered in Montreal, Canada with offices in Europe and Asia. Aimtec's research, development and design is driven by technological advancements, industry trends and market needs. Aimtec's product portfolio includes modular AC-DC and DC-DC switching power converters and LED drivers. Aimtec's designs are intended to assist customers worldwide in reducing engineering design time and expense, while facilitating miniaturization and performance enhancement of their applications.

The depth of Aimtec's electronic design capabilities allow it to deliver highly integrated power supplies that provide energy efficient, cost-effective solutions for a multitude of applications. Aimtec's stringent guidelines for design criteria have made its power converters renowned for being reliable, robust products that are best in their class for their technical parameters and their quality/cost ratio. Aimtec's AC-DC and DC-DC power supplies are recognized for exceeding industry norms in terms of features, performance, safety standards and power density.

In 2013, following the electronics trend of miniaturization, Aimtec began the development of industry-first, low voltage (1, 2, 3 watt) power modules that provide the unique capability of combining a single and three phase input AC voltage into a single power module. These new modules are particularly suited for industrial or building automation applications where a 3 phase transformer with very low efficiency is used to accommodate an input voltage up to 528VAC while providing high efficiency conversion in a very small package.

During our development process we used the most common 3-phase 480VAC systems: the 480VAC Δ connection

system and the 277/480VAC Y connection system. There might be a neutral in a 480VAC Δ system and if so, it would be part of a 240/480VAC single-phase system and would be rather unusual. The 480VAC corner grounded Δ supply system is essentially obsolete. For new construction, the 277/480VAC Y supply system is preferred because:

1. it can supply substantial power to three-phase loads, and
2. it can supply 277VAC single-phase loads, including fluorescent lighting, using "300 volt class" wiring. Also, a 480-to-120VAC system is practical for most applications in North America:
 - i. Control power units need to reduce the supplied voltage to lighting systems, test and control equipment, machinery, etc.
 - ii. Medical instruments need reduced AC voltage to plug them in directly.
 - iii. In several countries, power line instability must be considered. As an example: The power line supply system in India has very wide upper and lower voltage variations - this is also the case in other under developed countries.

With all these considerations, the first priority for this cutting edge design was to develop a direct plug-in type switching mode power unit that could provide voltage stability with high efficiency, high Isolation and very low no-load power consumption that would comply with all green initiatives and regulations.

These power modules allow the application system to be grounded to Earth in different terminal connection combinations while staying in EN55022 class B EMI compliance.

In the most modern applications where the AME1-AZ, AME2-AZ or AME3-AZ series are used and the system protection is on first place to consider, direct connection to Earth or Ground could be applied to the Input or to the Output terminals and the equipment will remain in electromagnetic compliance with the levels required for safe human operation.

Design challenges to design an AC-DC Switching power supply with ultra-wide input 90-528VAC

It is extremely difficult for electronic components to meet the full input voltage range with their standard specifications. To overcome this design barrier, the components had to be used in series or in parallel connection.

1. The main challenge for these modules is to be designed in such small form factor and PCB layout, since the number of components is increased due to the high input voltage range and to meet the safety requirements.
2. Another great challenge for this design was to meet the EMC compliance and to incorporate EMI filter and EMC protection circuit in this very limited space.
3. The most difficult part of the design was the Hi-Pot test and the reason for that is the much smaller case than a traditional design would allow. The typical isolation

distance by the safety standard IEC60950-1 is minimum 6 mm from primary to secondary side. In AME1-AZ, AME2-AZ or AME3-AZ series design there is only 14 mm of physical space to place the components on the PCB with respect to primary and secondary side.

4. Last but not least, the challenge with this design was how to fill the internal space with epoxy in order to split the heat equally and dissipate as much heat as possible to keep the part sufficiently cool during operations. As this is a very intensive design, the uniformity of the potting process became very essential.

Internal circuit design

Even with the doubled Input Voltage range of 90-528VAC, AME1-AZ, AME2-AZ or AME3-AZ series AC-DC Converters contain all of the modules incorporated in the standard power supplies working in the standard universal 1 phase input voltage range of 90-264VAC, as shown in **Figure 1**.

Because of the incorporated Bridge rectifier these switching power supplies may be used as low power (1, 2 and 3Watt) DC-DC Converters with input range 135 – 745VDC.

All internal electronic components are based on the standard rated and sizes available on the market. The design is an elegant compact combination of standard electronic components with unique mixture to deliver an industry innovative product.

The cutting-edge technology series AME1-AZ, AME2-AZ and AME3-AZ designed as class II power supplies (with no Earth/Ground input pin) have the advantage of

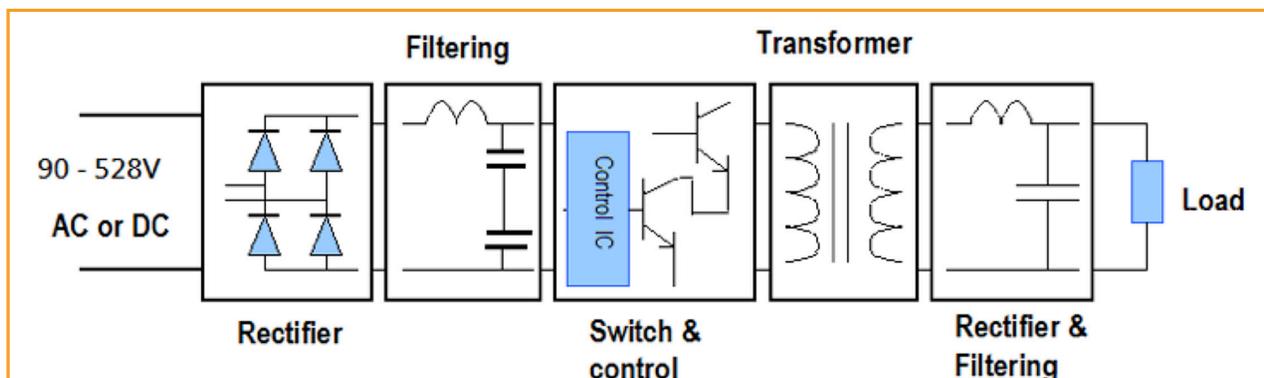


Figure 1

performance not only in the wide range of input voltage (90-528VAC) but also to perform with stable EMI compliance when connected to Earth or Ground. Without the need of an external EMI filter this power supplies are able to meet the EMI compliance with connections to Earth/Ground as shown in **Figure 2** below.

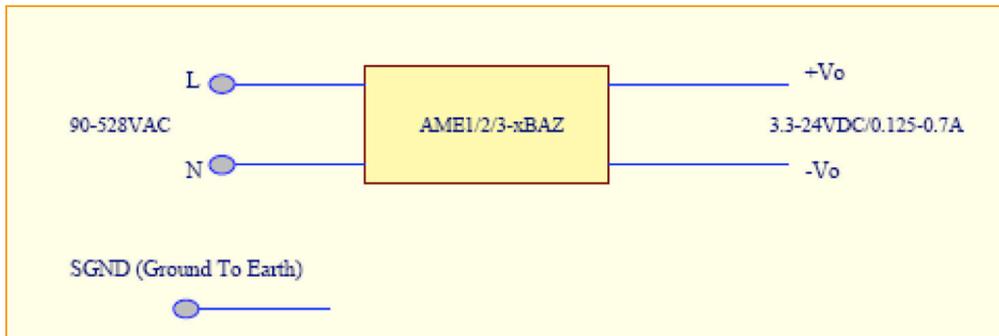


Figure 2

Conclusion

AME1-AZ, AME2-AZ and AME3-AZ series with its models with ultra-wide input voltage range of 90-528VAC are remarkable unique low power AC-DC Converters with very low standby power, full of features and offering an exceptional advantage for applications such as home automation, powering control boards and any other applications where small power is supplied from a 3 phase power source or the power line has with huge variations.



AME1, 2, 3 series